

37. \perp to $y = x^3 - 3x + 1$ at $(2, 3)$

39. points on $y = 2x^3 - 3x^2 - 12x + 20$
where tan || x-axis
slope $= 0 = y'$

Sep 12-9:00 AM

3.3b Rules for Differentiation

Use **Product Rule**.tms to discover the rule for taking derivatives of products of functions.

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$$\frac{d}{dx}(uv) = u \frac{dv}{dx} + v \frac{du}{dx}$$

$$\left\{ \frac{d}{dx}(uv) = \frac{du}{dx}v + u \frac{dv}{dx} \right\}$$

Take derivatives of these functions	1
$f(x) = x \cdot \sin(x)$	
$f(x) = x^2 \cdot \sin(x)$	
	095

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Take the derivative of $y = (x^2 + 1)(x^3 + 3)$

a) using the product rule

$$\begin{aligned} \frac{dy}{dx} &= (x^2 + 1)3x^2 + (x^3 + 3)2x \\ &= 3x^4 + 3x^2 + 2x^4 + 6x \\ &= 5x^4 + 3x^2 + 6x \end{aligned}$$

b) foil and take the derivative

$$y = x^5 + 3x^2 + x^3 + 3$$

$$\frac{dy}{dx} = 5x^4 + 6x + 3x^2$$

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The Quotient Rule

$$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$$

Differentiate $f(x) = \frac{x^2 - 1}{x^2 + 1}$

$$f'(x) = \frac{(x^2 + 1)2x - (x^2 - 1) \cdot 2x}{(x^2 + 1)^2}$$

calc: $\frac{4x}{(x^2 + 1)^2}$

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Power rule for negative integer powers of x

$$\frac{d}{dx}\left(\frac{1}{x}\right) = \frac{d}{dx}(x^{-1}) = -x^{-2} = -\frac{1}{x^2}$$

$$\frac{d}{dx}\left(\frac{1}{x}\right) = \frac{x \cdot 0 - 1 \cdot 1}{x^2} = -\frac{1}{x^2}$$

use quotient rule

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Find an equation for the line tangent to the curve $y = \frac{x^2 + 3}{2x}$ at $x = 1$

$$y' = \frac{(2x)2x - (x^2 + 3) \cdot 2}{(2x)^2} \bigg|_{x=1} = \frac{4 - 4 \cdot 2}{2^2} = -1$$

$$y = -(x - 1) + 2$$

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Example 9 p 123

 t = number of trees x = time (years) y = yield per tree (bushels) p = production from whole orchard

$$p = t \cdot y$$

$$\frac{dp}{dx} = t \cdot \frac{dy}{dx} + y \frac{dt}{dx}$$

$200 \text{ trees} \cdot 1.2 \frac{\text{bushels}}{\text{year}} + 15 \frac{\text{bushels}}{\text{tree}} \cdot 15 \frac{\text{trees}}{\text{year}}$

↑
increase
in total
production

↑
increase in
yield per tree
per year

increase in
trees/year
(# new trees
in 1 year)

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